A CAUSAL MODEL OF THE INFLUENCE OF PERSONALITY TYPE PREFERENCES ON STUDENTS' ACHIEVEMENT IN SENIOR SECONDARY SCHOOL BIOLOGY IN OSUN STATE, NIGERIA.

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Abstract:*The study reported here was conducted to investigate through path linkages how students' personality types preferences influence thier achievement in Biology at the Senior Secondary School (SSS) level. This study was based on the Myers-Briggs Personality Type Model that characterised personality type on : Extroversion, Sensing, Thinking and Judging (ESTJ). The study adopted survey research design. Congnitive Type Inventory (CTI) and Biology Achievement Test (BAT) were administered on 1,480 SSS II Biology students. The data were analysed using Statistical Package For Social Sciences (SPSS) Computer Programme. The results were presented using Path Analysis and Correlation Matrix. The findings established that the re-specified model was consistent with the hypothesized recurcive model by 71.4%. Sensing (.418) and thinking (.376) were the most significant in determining students' achievement in Biology. The discrepancy between the obtained and the re-preduced correlation coefficient was minimal (28.6%). Students should develop and exhibit sensing and thinking preferences when learning Biology.*

Keyword*: Personality type preferences, Students' achievement in Biology, Senior Secondary School in Osun State.*

1. INTRODUCTION:

Biology is a branch of science that deals with the study of plants and animals and the interactions between them. It is the subject that stands to discuss and provide solutions to all health related problems in any society. It is the key to the existence of a healthy nation. This implies that, a society that fails to pay quality attention to the study of biology in this scientific age may be characterized by unhealthy citizens. The relevance of the study of biology to industry, health care delivery, environmental protection, agriculture, personal understanding of body organs and their functions, prevention and control of various diseases cannot be overemphasized. Also, it is the subject that prepares all children for the challenges ahead of them as they undergo different stages of biological development from childhood to adulthood which incidentally occur during their secondary school age. Children should not be left out to have wrong knowledge about sensitive issues like puberty, menstruation, reproduction, child bearing and maintenance of body organs. It is only biology that can provide them with the correct and comprehensive knowledge about all these health related issues. Therefore, the effective teaching and learning of biology at the secondary school level must be given quality attention. More important, the ways by which students can improve their achievement in the subject must be a thing of concern for all stakeholders of education. Many scholars have associated students' academic achievement with many factors. Some of these factors include: teacher quality (Labo-Popoola, 2003); feelings of student (Bell, 201l); motivation (Rossano, 2011); parental involvement (Edeh and Vikoo, 2013); students' interest in biology, students' ability to do practical (Wabuke, 2013); goal commitment (Allan, 2014). In spite of these attempts, there is still need for continuous investigation into the relationship between student related factors and academic achievement. In view of this, this study investigated the influence of learners' personality type preferences on students' achievement in secondary school biology.

Learners who are aware of their personality type preferences may be able to understand their nature. This may enable them to acknowledge and embrace the characteristic ways by whichthey could learn best. This may go a long way in determiningtheir achievement. For example, Felder, Felder and Dietz, (2002) reported that a learner who is usually energized by being withpeople and interacting with them, and can often think best if he can talk over his ideas with other people is considered an extrovert. This implies that such a leaner will learn effectively in dependent situations but not in independent ones. Felder and Brent (2000); Provost (1992) said that, being sensitive to the role that personality type plays in learning and teaching cannot only make a student's first encounter with the different subjects less of a dismay, it may also help make learning interesting. Emeke (2006) said that the characteristic patterns of thoughts, feelings and behaviors that make a person unique define that person's personality. John (2006) viewed personality type as a comfort zone where thinking occurs with less effort and with the greatest trust. Personality type preferences are the characteristic thoughts, feelings and behaviors which learner tend to exhibit in a learning situation and which takes a discontinuous approach (Phare, 1991). Several models of personality type have been developed and

used to measure personality. Some of thesemodels are: Myers-Briggs Personality Model, The Big Five Factor Personality Model,Cattell's 16PF Model, Saville and Holdsworth's OPQ (Occupation Personality Questionnaire) Model, and Belbin 'team role' Personality Model. Myers and Caulley (1986) confirmed that the only commonly used among these models to measure personality type is Myers-Griggs Personality Model.Other personality models measure personality traits. According to Myers and Caulley (1986), Myers-Briggs Personality Model was developed in the early 1950's by Isabel Briggs Myers and Katherine cooks Briggs. In the Myers-Briggs Personality Model, it is proposed that anindividual's personality profile can be factored into four dimensions. These dimensions are: Orientation to life (Extroversion/Introversion), Perception (Sensing/Ntuition), Decision making (Thinking/Feeling), and Attitude to the outside world (Judging/Perception). Considering the four Myers−Briggs dimensions of personality, it implies that an individual's personality can be described by two major personality types. They are; personality type −ESTJ (Extroversion, Sensing, Thinking, Judging) and personality type –INFP (Introversion, iNtuition, Feeling, Perception). The preferences for personality type – ESTJ are extroversion, sensing, thinking, and judging whereas, the preferences for personality type- INFP are introversion, iNtuition, feeling, and perception.

John (2006) identified the characteristics that students exhibit for Myers-Briggs Personality Type − ESTJ (Extroversion, Sensing, Thinking, and Judging) as:

Extroversion preference: Students who have extroversion preference learn best through quick-trial-and-error thinking. They have an easier and more effective learning experience when they verbalize their learning as it is happening.

Sensing preference: Sensing types tend to trust information that is perceived directly by the senses, i.e. vision, audio, touch (manipulation), taste, and smell. They are always comfortable with facts and past events when studying in a group.

Thinking preference: Thinkers tend to trust their logic to evaluate the facts and possibilities. They are impersonal and objective in their analysis. Thinking types draw attention to the "correctness" of relationship and the clarity of thinking when studying in a group.

Judging Preference: Students who have judging preference tend to organize their time around a plan. They are motivated to obtain closure by completing their plan or checking off items on their task list. They tend to sacrifice learning additional information if that learning will prevent them from completingtheir schedule. When studying in a group, they keep the group on task and help it tobe more efficient.

Examining the four preferences of Myers-Briggs Personality type-ESTJ and the characteristics that students tend to exhibit for each of them, it isobvious that they are relevant to the teaching-learning situation in the field of biology. In view of this, Myers-Biggs Personality type-ESTJ was the focus of this study.

2. STATEMENT OF THE PROBLEM

Poor performance of students in biology at the senior secondary school level over the years has raised a great concern among stakeholders. Previous studies on this performance trend in biology have focused more on factors relating to home, school, and students demographic variables with little concern for their personality type preferences based on Myers-Briggs model. Therefore, this study examined through path linkages how Myers-Briggs personality type- ESTJ (Extroversion, Sensing, Thinking, Judging) preferences, gender and age determine students' achievement in biology.

3. RESEARCH QUESTIONS (RQ)

Based on the stated problem the study provided answers to the following questions.

RQ$_1$: Is the parsimonious model which describes the causal effects among the variable (gender, age, extroversion, sensing, thinking, judging, and biology achievement) consistent with the hypothesized recursive model of these variables?

RQ$_2$: What is the pattern of correlations in the model consisting of gender, age, extroversion, sensing, thinking, judging, and biology achievement?

RO$_3$: Is the reproduced correlation coefficients among the variables (gender, age, extroversion, sensing, thinking, judging, and Biology achievement) consistent with the obtained correlation coefficients among these variables?

4. METHODOLOGY

4.1 Research design

The study which is part of a larger study used survey research design.

4.2 Population

The target population comprised all the Senior Secondary School Two (SSS II) biology students in the thirty one local government areas of Osun State.

4.3 Sample

Twenty SSS II students (male and female) were randomly selected from each of the seventy four Senior Secondary Schools in the fifteen selected Local Government Areas of Osun State, Nigeria. Thus, a total of one thousand, four hundred and eighty (1,480) students were selected using purposeful sampling technique.

4.4 Instrumentation

Two instruments were used to collect data
- Cognitive Type Inventory (CTI)
- Biology Achievement Test (BAT)

Cognitive Type Inventory (CTI): CTI was an adapted instrument from Ross (2006). The instrument which contained twenty four (24) items, measured the respondents' personality type-preferences (extroversion, sensing, thinking and judging). A three point scale of **Very True of Me [VTOM (3), True of Me [TOM (2): Not True of Me [NTOM (1)]** was used for the respondents to select which statement best fits their personality type preference. Section Aof the instrument contained four items on bio-data and school background information of the student, that is School Name, Sex, Class, Age. The content validity index of CTI was established at 0.71. The estimated reliability of CTI was established at 0.52 Cronbachcoefficient alpha value. The indices show that the instrument is valid and reliable.

Biology Achievement Test (BAT): This consists of two sections. Section A focused on the demographic data of the student that is, School Name, Sex, Class, and Age. Section Bfocused on 7 topics. The topics are: Biology and Living things, Plant and Animal nutrition, Ecological concepts and functioning ecosystem, Ecological management and conservation, Micro-Organisms and better health, The cell and its environment, Tissue and supporting system. The total numbers of test items is 60. The items were developed based on Bloom's Taxonomy to measure cognitive domain. This includes the recall or recognition of the specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. Three major categories or levels of cognitive domain were considered. They are: knowledge, comprehension, and application. The test achievement blue print in Table 2 presents the distribution of items over different topics. The estimated reliability coefficient of BAT using Kuder Richardson (KR-20) was 0.75. The difficult indices of the item were between 0.40 and 0.75 while the discrimination indices were between 0.32 and 0.45.

Table 2: Test blue Print for a 60 Multiple Choice Items on Biology

S/N	Topics	Knowledge	Comprehension	Application	Total %
1.	Biology and Living Things	3, 4, 5, 6, 7, 8, 10, (07) 11.7%	2, (1) 1.7%	1, 9, (2) 3.3%`	(10) 16.6%
2.	Plant and Animal Nutrition	12, 14, 15, 18, 19 (5)8.3%	11, 16, 17, (3) 5%	13,20, (2) 3.3%	(10) 16.6%
3.	Ecological concepts and Functioning Ecosystem	22, 28, (2) 3.3%	26, 27, (2) 3.3%	13,20 (2) 3.3%	(08) 13.3%
4.	Ecological Management and Conservation	29, (1) 1.7%	30, 31, 32, 34, 35, 36, (6) 10%	33, (1) 1.7%	(08) 13.3%
5	Micro-Organisms and Better Health	37, (1) 1.7%	39, 40, 43, (3) 5%	38, 41, 42, (3) 5%	(07) 11.7%
6.	The Cell and it's Environment	44, (1) 1.7%	45,47,48,49,50, (5) 8.3%	46, 51, (2) 3.3%	(08) 13.3%
7.	Tissue and Supporting System	55, 56, 57, 60, (4) 6.7%	52, 53, 59, (3) 5%	54, 58, (2) 3.3%	(09) 15%
Total		(21) 35%	(23) 38.3%	(16) 26.6%	(60) 100%

4.5 Data collection

Two research assistants were trained for two days on how to handle the administration of the research instruments effectively. The researcher personally monitor the administration of the instruments. The administration of the instruments in each school was in the sequence of CTI coming up the first day, and BAT the second day. Data collection exercise lasted for seven weeks.

4.6 Data Analysis Procedure

Path Analysis and Multiple Regression were used to analyze the data collected for the study to test the three stated research questions.

5. RESULTS:

RQ$_1$: Is the parsimonious (re-specified) model which describes the causal effects among the variable (gender, age, extroversion, sensing, thinking, judging, and biology achievement) consistent with the hypothesized recursive model of these variables?

Table 3: Path Coefficient of the Obtained Hypothesized Recursive Model.

Path	Path Coefficient	Significance	Decision
P_{31}	**-.154*****	Significant	Retained
P_{41}	-.120***	Significant	Retained
P_{51}	.028	Not significant	Deleted
P_{61}	-.125***	Significant	Retained
P_{71}	-.011	Not significant	Deleted
P_{32}	-.010	Not significant	Deleted
P_{42}	.062**	Significant	Retained
P_{52}	.094**	Significant	Retained
P_{62}	.064**	Significant	Retained
P_{72}	-.058**	Significant	Retained
P_{73}	-.298***	Significant	Retained
P_{74}	-.097**	Significant	Retained
P_{75}	.117***	Significant	Retained
P_{76}	-.026	Not significant	Deleted

Note: P < .05; P < .01; P < .001
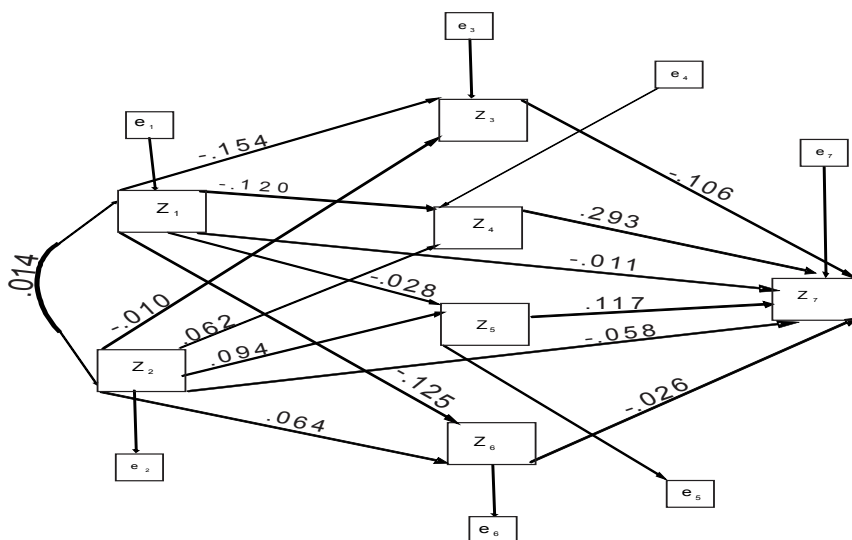

Figure. 1: Hypothesized Recursive Model of a seven variables System showing Path Coefficient

Key:

Z_1 =Gender Z_2= Age Z_3 = Extroversion Z_4 = Sensing Z_5 = Thinking

Z_6 = Judging Z_7 = Achievement

The path coefficients were written on each pathway of the hypothesized recursive model (see figure 1). From table 3, paths which are not statistically significant were deleted.

Therefore, paths P_{32}, P_{51}, P_{71}, and P_{76} were deleted. Thus, the re-specified model is produced.

Table 4: Paths Coefficients of the Re-specified Model

Path	Path Coefficient	Significant	Decision
P_{31}	**-.154*****	Significant	Retained

P_{41}	-.120***	Significant	Retained
P_{61}	-.125***	Significant	Retained
P_{42}	.062**	Significant	Retained
P_{52}	.094**	Significant	Retained
P_{62}	.064**	Significant	Retained
P_{72}	-.058**	Significant	Retained
P_{73}	-.298***	Significant	Retained
P_{74}	-.097**	Significant	Retained
P_{75}	.117***	Significant	Retained
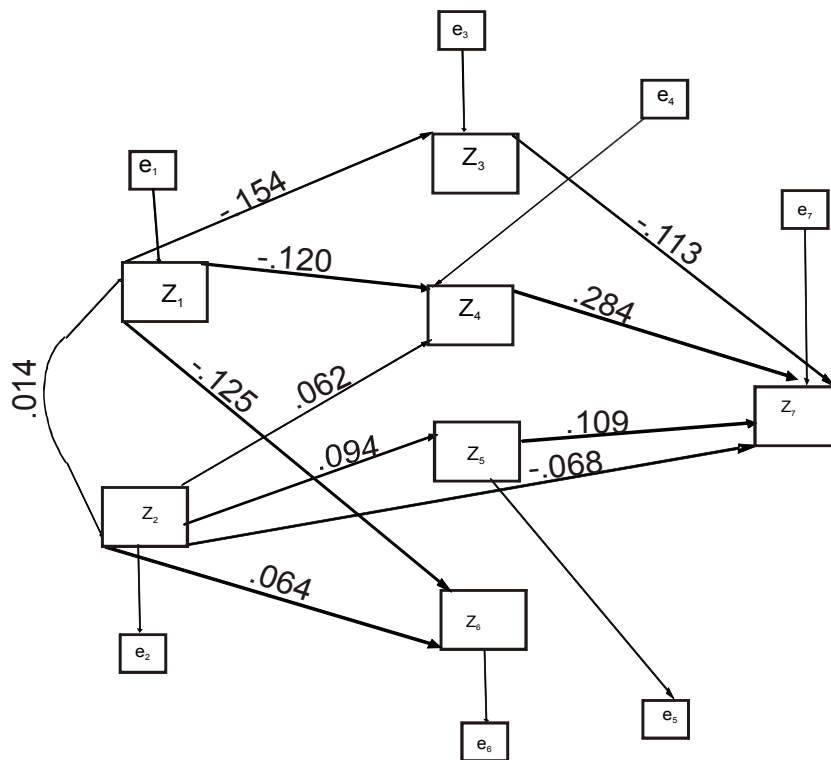
Figure.2 Re-specified Model Showing Path Coefficients
Key: Z_1 = Gender Z_2 = Age Z_3 = Extroversion Z_4 = Sensing Z_5 = Thinking
        Z_6 = Judging Z_7 = Achievement
DISCUSSION

The findings of the study established that out of the fourteen (14) causal paths in the hyothesized recurcive model (fig. 1) only ten (10) were significant for producing the re-specified causal model. This accounted for 71.43%. This means that the new model is by 71.43% able to give an empirical explanation of the influence of gender, age, extroversion, sensing, thinking, and judging on students' achievement in biology. This is consistent with the findings of Adele et al., (2007); Terrance et al., (1998) who established that extroversion, thinking, and judging were predictor variables to achievement.

RQ₂: What is the pattern of correlations in the model consisting of gender, age, extroversion, sensing, thinking, judging, and biology achievement?
Table 5: Obtained Correlation Coefficients

Variables	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7
Z_1	**1.000**						
Z_2	.014	**1.000**					

Z_3	**-.154**	**-.012**	**1.000**			
Z_4	**-.119**	.060	.637	**1.000**		
Z_5	.029	.094	.542	.755	**1.000**	
Z_6	**-.124**	.063	.692	.803	.671	**1.000**
Z_7	**-.074**	**-.008**	**-.269**	.417	.376	.327	**1.000**

Key: $Z_1 =$ Gender $Z_2 =$ Age $Z_3 =$ Extroversion $Z_4 =$ Sensing $Z_5 =$ Thinking
        $Z_6 =$ Judging$Z_7 =$ Achievemen

Table 6: Reproduced Correlation Coefficients

Variables	Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7
Z_1	**1.000**						
Z_2	.014	**1.000**					
Z_3	**-.154**	**-.002**	**1.000**				
Z_4	**-.119**	.060	.017	**1.000**			
Z_5	.001	.094	**-.001**	.006	**1.000**		
Z_6	**-.124**	.062	.018	.019	.002	**1.000**	
Z_7	**-.066**	**-.011**	.269	.418	.376	.334	**1.000**

Key: $Z_1 =$ Gender $Z_2 =$ Age $Z_3 =$ Extroversion $Z_4 =$ Sensing $Z_5 =$ Thinking
        $Z_6 =$ Judging$Z_7 =$ Achievement

Discussion

From tables 5 and 6, it was revealed that gender, extroversion, sensing, thinking and judging have significant relationship with biology achievement. This is so because the types of attributes which extrovert, sensors, thinkers, and judgers naturally possess are those that can make them learn biology effectively. This findings is consistent with the work of Archana (2007) who found that exrovertion, sensing,thinking and judging were correlates of students' performance. However, statistically insignicant correlation existed between age and biology achievemnet. This disagrees with the finding of Grasha (1996) who established a significant reationship between age and student achievement. The reason for the present finding could be associated with the fact that, more often than not learners consider themselves equal as far as they are classmate not minding the age differenece.

RO$_3$:Is the reproduced correlation coefficients among the variables (gender, age, extroversion, sensing, thinking, judging, and biology achievement) consistent with the obtained correlation coefficients among these variables?

Table 7: Differences between Obtained and Reproduced Correlation Coefficients

Correlation	Obtained	Reproduced	Difference
r_{12}	.014	.014	.000
r_{13}	-.154	-.154	.000
r_{14}	-.119	-.119	.000
r_{15}	.029	.001	.028
r_{16}	-.124	-.124	.000
r_{17}	-.074	-.066	-008
r_{23}	-.012	-.002	-.010
r_{24}	.060	.060	.000
r_{25}	.094	.094	.000
r_{26}	.063	.062	.001
r_{27}	-.008	-.011	.003
r_{34}	.637	.017	.620 *
r_{35}	.542	-.001	.543 *
r_{36}	.692	.018	.674 *
r_{37}	.269	.269	.000
r_{45}	.755	.006	.749 *
r_{46}	.803	.019	.784 *
r_{47}	.417	.418	-.001
r_{56}	.671	.002	.669 *
r_{57}	.376	.376	.000
r_{67}	.320	.334	-.007

Note: difference between obtained and reproduced correlation coefficient is greater than .05

Discussion

The efficacy of the re-specified model was further verified by comparing the obtained and reproduced correlation coefficients. It was established that, six (6) of the twenty one (21) reproduced correlations have differences greater than 0.05 criterion. This difference accounted for 28.6%. This shows that the model described the causal effects of the variables and thier correlations. This corroborate the study of Kerlinger and Lee (2000) who reported that hypothesized model fits the empirical data when the difference between hypothesized and reproduced correlation coefficients fall under 40%.

6. CONCLUSION:
It could be concluded from the findings of this study that students are bound to perform well in biology if they are able to develop and exhibit personality type preferences (extroversion, sensing, thinking, and judging).

7. RECOMMENDATIONS:
Based on the discussion on the findings of this study, the following recommendations are offered;
a. Students should endeavour to develop and exhibit personality type preferences (extroversion, sensing, thinking, and judging) so as to enhance their achievement in biology.
b. Biology teacher should adopt and combine right approaches that could encourage and allow students exhibit extrovertion, sensing, thinking, and judging preferences.
c. Since students spend most of their time at home with their parents, thus, parent should not discourage them each time they exhibit extroversion, sensing, thinking, and judging preferences.

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